

Production Optimization through integrated simulation between reservoir and gas gathering network in Zapolyarnoe gas field

- Ivan Polekhin
- Andrey Lepikhin
- National Centre for Development of Innovative Technologies 'Delta'
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Operations Management

It's crucial to consider product gathering system while simulating reservoir. Especially when your hydrocarbon field is highly productive.





Hydrocarbon reservoir



High productivity is the reason for frequent synchronization of reservoir model and product-gathering network model.



Hydrocarbon reservoir



According to our research, infrequent synchronization may cause up to 10% difference in total production even in the simplest case.



Hydrocarbon reservoir



It makes manual synchronization of reservoir model with product-gathering network model impossible if you want to obtain realistic results.



Hydrocarbon reservoir



National Centre for Development of Innovative Technologies 'Delta', which is closely affiliated with the Russian Academy of Sciences, and Invensys start cooperation in order to develop a solution for integrated simulation based on already existing well-established products:

- TimeZYX Suite and, in particular, reservoir simulator MKT
- Steady-state product-gathering system simulator PipePhase



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TimeZYX Suite

- More than 7 years of development. Partly in cooperation with one of the leading Russian research institutes – Keldysh Institute of Applied Mathematics of the Russian Academy of Sciences.
- Successfully tested on models of real fields of Russia, Ukraine, Kazakhstan, and China.
- Used in the leading Russian companies.



Arlan Oil Field



Size: 100 x 30 km Developed since 1959 Well drilled (01.01.2008): 8 582 Size of the geological model (93% of total reserves) – 1 000 000 000 cells (approx) Computation time (512-cores cluster) – 12 hrs.



Talinskoe Oil Field



Size: **120 x 32 km** Size of the geological model **79 000 000 cells** Developed for more than **25 years** Wells drilled: **5215** Main features: **high fracturing** and **high water-cut**



Zapolyarnoe Gas Field



- Almost 20% of gas produced in Russia annualy
- More than 450 highly-productive wells
- Reservoir model with more than 2 000 000 cells
- > 20 years forecast

The task was to find the optimal work schedule for the ground equipment and to maximize the period of required productivity.



Convertation and matching

Part 1: *to match with history.* Results obtained in MKT match well with history (only reservoir model):



Part 2: to convert correctly gas-gathering model to PipePhase format.

- Hagedorn & Brown for wells (two-phase fluid, typical ID < 100mm)
- Orkiszewski for ground network system (two-phase fluid, large ID)
- U-value for heat transfer modeling



Certified solution for integrated simulations based on the IPR curves approach







Gas rate with seasonal variations

m³/day



Important note: seasonal variations as well as the technological restrictions of compressors were predefined by the customer.



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Thank you for your attention



+7 (495) 517-33-99+7 (495) 663-7773info@deltaru.ruInfo.rus@invensys.comwww.deltaru.ruwww.iom.invensys.ru